What is claimed is:

1. A three-dimensional textile composite structure with energy-absorbing capacities under multiple impacts, comprising:

a base, and

at least one progressively collapsible projection extending from the base for absorbing energies under the multiple impacts,

wherein the projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after the first impact of the multiple impacts.

2. The structure of Claim 1, wherein the projection has a grid-domed shape.

3. The structure of Claim 1, wherein the non-woven textile material is made from staple fibers with a random orientation.

4. The structure of Claim 3, wherein the staple fibers have a low level of anisotropy in mechanical properties.

5. The structure of Claim 1, wherein the thermoplastic matrix material has a melting temperature lower than the no-woven textile material.

6. The structure of Claim 1, wherein the non-woven textile material is impregnated with the thermoplastic matrix material by the following steps:

laminating a layer of the thermoplastic matrix material with a layer of the non-woven textile material;

heating the laminate to a processing temperature higher than the melting temperature of the thermoplastic matrix material but lower than the melting temperature of the non-woven textile material; and

applying pressure to the heated laminate for impregnating the non-woven textile material with the melted thermoplastic matrix material.

7. A process for manufacturing a textile composite structure capable of retaining energy-absorption capacity at least after the first impact of multiple impacts, comprising:

providing a layer of non-woven textile material;

laminating a layer of thermoplastic matrix material with the non-woven textile layer, the thermoplastic matrix material melting at a lower temperature than the non-woven textile;

heating the laminate to a processing temperature higher than the melting temperature of the thermoplastic matrix material but lower than the melting temperature of the non-woven textile material;

applying pressure to the heated laminate for impregnating the non-woven textile material with the melted thermoplastic matrix material; and

molding the non-woven textile material impregnated with the thermoplastic matrix material to a desired shape with a base and a plurality of progressively collapsible projections extending from the base.

8. The process of Claim 7, wherein the heating step includes raising the processing temperature to at least five degrees higher than the melting temperature of the thermoplastic matrix material.

9. The process of Claim 7, wherein the projections have a grid-domed shape.

10. The process of Claim 7, wherein the non-woven textile material is made from staple fibers with a random orientation

11. The process of Claim 10, wherein the staple fibers have a low level of anisotropy in mechanical properties.

12. The process of Claim 7, further comprising:

obtaining the non-woven textile layer by processing a layer of fabrics using a process selected from needle-punching, water jet penetration, melting binding, adhesive bonding, melt-blowing and bonding by adhesive fibers.

13. An energy-absorbing door, comprising:

inner and outer panels joined together in spaced apart relation; and

an energy absorbing structure provided on the inner panel including at least an energy-absorbing sheet of textile composite having a base and a plurality of projections extending from the base,

wherein each projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after an initial impact.

14. A safety headwear, comprising:

an outer shell; and

an energy-absorbing liner within said outer shell including at least an energy-absorbing sheet of textile composite having a base and a plurality of projections extending from the base,

wherein each projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after an initial impact.

15. A body protective gear, comprising:

an outer surface; and

an energy-absorbing liner within the outer surface including at least an energy-absorbing sheet of textile composite having a base and a plurality of projections extending from the base,

wherein each projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after an initial impact.

16. A protective package, comprising

an outer shell; and

an energy-absorbing liner within the outer shell including at least an energy-absorbing sheet of textile composite having a base and a plurality of projections extending from the base,

wherein each projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after an initial impact.

17. A seat cushion, comprising

an outer shell; and

an energy-absorbing liner within said outer shell including at least an energy-absorbing sheet of textile composite having a base and a plurality of projections extending from the base,

wherein each projection includes a non-woven textile material supported in a thermoplastic matrix material such that the projection is capable of retaining energy-absorption capacity at least after an initial impact.